

Identification of the Radiological Features of Musculoskeletal Tuberculosis by Using X Ray/Ultrasonography/Computer Tomography/Magnetic Resonance Imaging

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ABSTRACT

Background: Tuberculosis remains a major global public health problem. The present study was conducted with the aim of identifying the radiological features of musculoskeletal tuberculosis by using X Ray/ultrasonography/computer tomography/magnetic resonance imaging. **Methods:** The cases for the study included a minimum of 50 patients with clinical suspicion of tuberculosis, being referred from various departments to the department of radiodiagnosis. Ultrasound was obtained with patient supine, with a curvilinear and linear array real time B-mode ultrasound machine "GE Logic V5" equipped with a 3.5 MHz and 7.5 MHz transducer to assess for joint effusion, tenosynovitis and for guided aspiration for microbiological and histopathological examination. MRI is the modality of choice in detection of joint tuberculosis and may be helpful to delineate the precise extent of soft tissue. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software. **Results:** A total of 50 patients were included in the study. Majority of the patients belonged to the age group of 10 to 40 years. Tubercular spondylodiscitis on MRI showed Thecal sac indentation in 52 percent of cases, while they depicted narrowing of intervertebral disc space in 78 percent of the cases. Abscess was seen in 58 percent of the cases. Ultrasound findings in musculoskeletal tuberculosis showed presence of psoas abscess in 10 patients with tubercular spondylodiscitis while they showed synovial thickening and joint effusion in 5 patients with tubercular arthritis. **Conclusions:** MRI is highly sensitive in detecting characteristic early bone marrow changes of affected bones.

Keywords: Radiographic, Musculoskeletal, Tuberculosis.

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INTRODUCTION

Tuberculosis remains a major global public health problem with 1.5 million deaths annually worldwide in 2014 according to WHO. One in five cases of tuberculosis presents as extra pulmonary TB posing major diagnostic and management challenges.^[1, 2] Musculoskeletal tuberculosis is one of the oldest diseases documented in ancient Egyptian mummies. Sir Percival Pott was the first person to tell the first modern case of spinal tuberculosis in 1779, after whom the disease is commonly referred to as "Pott's Spine".^[3] Tubercular spondylitis is most common musculoskeletal TB and is increasing in prevalence due to resurgence of tuberculosis during the past decade in patient with AIDS. Tubercular spondylitis is clinically a serious problem due to concomitant neurological deficit and therefore its early detection is quite essential.^[4]

Musculoskeletal TB accounts for 1-3% of tuberculous infections. The most common form of

musculoskeletal TB is tuberculous spondylitis (50%). Extra spinal manifestation are least common i.e. the reported frequency of peripheral arthritis is 60%, osteomyelitis 38% and tenosynovitis and bursitis 2%.^[5,6] Whereas according to Revised National TB Control Program (RNTCP) osteoarticular tuberculosis accounts for 10 to 18 % of extrapulmonary tuberculosis and 1%-5% of total tuberculosis case.^[7-8]

On plain radiograph a triad of juxta articular osteoporosis, peripherally located osseous erosion and progressive decrease of joint space is known as Phemister triad that suggest tuberculous arthritis of a joint. Other radiographic features include joint effusion and osteolytic bone destruction. Occasionally there may be areas of wedge-shaped necrosis known as kissing sequestra on either side of the joints. In end stage of tuberculous arthritis severe joint destruction and eventually, sclerosis and fibrous ankylosis is seen when active infection has extinguished.^[6-10]

Ultrasound findings may demonstrate the presence of joint effusion although it is not a specific diagnostic modality. Another important role of ultrasonography is aspiration of these effusions for microbiological and histopathological examination and PCR. Computer Tomography scan is particularly useful for evaluating the degree of bone

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destruction, sequestrum formation and surrounding soft tissue extension. Magnetic resonance imaging is investigation of choice for early detection of joint tuberculosis. Synovial proliferation can be depicted on MRI which is typically hypointense on T2W images and is a helpful sign that differentiates tuberculous arthritis from other proliferative synovial arthropathies. MRI is also useful in detecting associated bone marrow edema, osteomyelitis and soft tissue abnormalities such as myositis, cellulitis, para-articular abscess formation, tenosynovitis and bursitis.^[8-11]

Hence; the present study was conducted with the aim of identifying the radiological features of musculoskeletal tuberculosis by using X Ray/ ultrasonography/computer tomography/ magnetic resonance imaging.

MATERIALS & METHODS

The present study was conducted in the Department of Radio diagnosis, Rohilkhand Medical College and Hospital Bareilly, U.P It was a Prospective cross-sectional study of musculoskeletal tuberculosis in Rohilkhand region. The cases for the study included patients with musculoskeletal tuberculosis coming to the departments of orthopaedics, medicine and surgery at Rohilkhand Medical College & Hospital, Bareilly, Uttar Pradesh. The cases for the study included a minimum of 50 patients with clinical suspicion of tuberculosis, being referred from various departments to the department of radiodiagnosis.

Inclusion Criteria

- Patients with strong clinical suspicion of musculoskeletal tuberculosis.
- All age groups
- Both sexes

Exclusion Criteria

- Trauma patients
- Uncooperative patients
- Patients not willing to give consent

Depending on the clinical presentation and bones or joints involved, radiographs were obtained in various position i.e. anteroposterior, posteroanterior and oblique views were taken on 500 MA X Ray GE machine. In our study ultrasound was obtained with patient supine, with a curvilinear and linear array real time B-mode ultrasound machine "GE Logic V5" equipped with a 3.5 MHz and 7.5 MHz transducer to assess for joint effusion, tenosynovitis and for guided aspiration for microbiological and histopathological examination. Our study Computed Tomography was done using GE bright speed (16 slices) machine Computed tomography is useful to demonstrate extent of disease and pattern of bone destruction. MRI is the modality of choice in detection of joint tuberculosis and may be helpful to

delineate the precise extent of soft tissue. MR machine 0.4 Tesla Aperto Lucent (Hitachi) and 1.5 Tesla Magnetom Sempra- Siemens machine was utilized in our study. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software.

RESULTS

The present prospective study was conducted in the Department of Radiodiagnosis, Rohilkhand Medical College, Bareilly with the objective to study the role of imaging in Musculoskeletal Tuberculosis. A total of 50 patients were included in the study. Majority of the patients belonged to the age group of 10 to 40 years. 62 percent of the patients were males while the remaining were females. In 54 percent of the cases, diagnosis was tubercular spondylodiscitis and in 10 percent of the patients each, the diagnosis was tuberculosis of the hip joint and knee joint respectively. In 12 percent of the patients, the diagnosis was tubercular osteomyelitis. On X ray analysis in patients with tubercular spondylodiscitis, end plate irregularity and narrowing of intervertebral disc space was seen in 37% and 55 % of the patients respectively. Paravertebral shadow and reduce bone density was seen in 32 % and 40% of the patients. Patients with tubercular spondylodiscitis on CT analysis showed fragmentary findings in 48.1 percent of the patients while they exhibited osteolytic findings in 33.3 percent of the patients.

Tubercular spondylodiscitis on MRI showed Thecal sac indentation in 52 percent of cases, while they depicted narrowing of intervertebral disc space in 78 percent of the cases. Abscess was seen in 58 percent of the cases.

Ultrasound findings in musculoskeletal tuberculosis showed presence of psoas abscess in 10 patients with tubercular spondylodiscitis while they showed synovial thickening and joint effusion in 5 patients with tubercular arthritis.

Table 1: Distribution of patients according to location

Diagnosis	No. (n=50)	Percentage %
Tubercular spondylodiscitis	27	54
Tuberculosis of hip joint	5	10
Tuberculosis of knee joint	5	10
Tuberculosis of wrist joint	4	8
Tuberculosis of ankle joint	1	2
Tubercular osteomyelitis	6	12
Tuberculous tenosynovitis	1	2
Tuberculous myositis	1	2

Table 2: X-Ray findings in tubercular spondylodiscitis

Findings	No. of patients	Percentage
End plate irregularity	10	37.0%
Narrowing of intervertebral disc space	15	55.0%
Paravertebral shadow	8	32.0%
Reduced Bone Density	11	40.0%
Wedge Collapse	7	25.9%
Compression Fracture	4	15.0%
Vertebral Body Height Reduction	12	45.0%

Table 3: Pattern of bone destruction in tuberculous spondylodiscitis on CT

	Percentage	Total no. of patients
Fragmentary	48.1%	13
Osteolytic	33.3%	9
Sclerotic	11.1%	3
Subperiosteal	25%	7

Table 4: MRI findings in tubercular spondylodiscitis (n=27)

Findings	No. of patients	Percentage
Abscess	15	58%
Narrowing of intervertebral disc space	21	78%
Thecal Sac Indentation	14	52%
Spinal Cord Compromise/Canal Stenosis	3	12%
Cord Oedema	1	5%
Wedge Collapse	6	24%
Compression Fracture	4	14%
Vertebral Body Height Reduction	12	43%

Table 5: X-ray changes in tubercular osteomyelitis

Radiological characteristics	Number of patients (6)	Percentage
Osteopenia	4	66.66%
Lytic lesion	3	50%
Periosteal thickening	2	33.33%
Endosteal scalloping	1	16.66%
Loss of trabecular architecture	1	16.66%
Sequestrum	3	50%

Table 6: CT findings in tubercular osteomyelitis

CT findings	No. of patients (6)	Percentage
Cortical thinning/scalloping	2	33.33%
Periosteal reaction	3	50%
Sequestrum	4	66.66%
Soft tissue extension	3	50%

Table 7: MRI findings in tubercular osteomyelitis

Findings	No. of patients (6)	Percentage
Marrow edema	4	66.66%
Intramedullary abscess	3	50%
Soft tissue abscess/collection	3	50%
Cloaca	2	33.33%
Sinus tract	1	16.66%
Sequestrum	3	50%

Table 8: Ultrasound findings in musculoskeletal tuberculosis

Musculoskeletal Tuberculosis	USG findings	No. of patients
Tubercular spondylodiscitis	Psoas abscess/Paraspinal abscess	10
Tubercular arthritis	Synovial thickening, joint effusion	5
Tuberculosis of long bone	No clear indication until soft tissue extension/joint involvement	1
Tenosynovitis	Synovial thickening, joint effusion. Degree and extent of tendon and tendon sheath involvement.	1
Myositis	Guided aspiration of the collections	1

DISCUSSION

Tuberculous osteomyelitis may occur anywhere but most commonly it is seen in the bones of extremities, including the small bones of the hands and feet. It may be seen as multiple or solitary bone lesion. The most frequent site of involvement is the metaphysis but in rare cases the diaphysis may also be affected.^[11]

Plain radiography may demonstrate soft tissue swelling, periosteal reaction although minimal. Osteolysis with little or no reactive changes particularly osteoporosis and erosions can also be seen. Sclerosis and sequestrum are not commonly seen. But if present, sequestrum can be assessed accurately on CT. Osteitis cystica tuberculosa multiplex is also known as multifocal tuberculous osteomyelitis. In children there is involvement of multiple sites whereas in adults it is more often confined to single bone 18. In younger age group the lesions are generally variable in size, well defined and osteolytic without sclerosis. The lesions however may lead to metaphyseal expansion. On contrary in adults the lesions show well defined sclerotic margins. They are smaller in size and are located along the axis of the bone. Ultrasonography has no specific role in diagnosis of tuberculous osteomyelitis unless there is soft tissue or joint involvement.^[11] Hence; the present study was conducted with the aim of identifying the radiological features of musculoskeletal tuberculosis by using X Ray/ultrasonography/computer tomography/magnetic resonance imaging.

In the present study, majority of the patients belonged to the age group of 10 to 40 years. 62 percent of the patients were males while the remaining were females. In 54 percent of the cases, diagnosis was tubercular spondylodiscitis and in 10 percent of the patients each, the diagnosis was tuberculosis of the hip joint and knee joint respectively. In 12 percent of the patients, the diagnosis was tubercular osteomyelitis. On X ray analysis in patients with tubercular spondylodiscitis, end plate irregularity and narrowing of intervertebral disc space was seen in 37% and 55 % of the patients respectively. Paravertebral shadow and reduce bone density was seen in 32 % and 40% of the patients. In the present study, patients with tubercular spondylodiscitis on CT analysis showed fragmentary findings in 48.1 percent of the patients while they exhibited osteolytic findings in 33.3 percent of the patients. Sinan T et al defined the CT and MRI image morphology of spinal TB and correlated the imaging features of these two modalities. CT (29 patients) and MRI (11 patients) images were retrospectively analyzed in 30 patients with proved spinal TB. The majority of the 30 patients were males (n=18) in the 30–49 year age group (43%). The most common clinical presentation was backache (73.3%) followed by fever (63.3%) and

malaise (36.6%). The lumbar spine was the commonest site of the disease (43.3%) followed by the thoracic region (36.6%). A fragmentary type of bone destruction was the most frequent CT feature of the disease (48.2%) followed by the lytic type (24.1%). Intervertebral disc destruction (72%) and paravertebral mass/abscess (65.5%) were other features. Of the 11 patients who had an MRI, contiguous vertebral disease with disc destruction was seen in 10 cases. In 4 patients, there was distant vertebral disease in addition to the disease at the symptomatic site. MRI offers excellent visualization of the bone and soft tissue components of spinal tuberculosis and helps to identify disease at distant asymptomatic sites.^[13]

In the present study, Tubercular spondylodiscitis on MRI showed Thecal sac indentation in 52 percent of cases, while they depicted narrowing of intervertebral disc space in 78 percent of the cases. Abscess was seen in 58 percent of the cases. Jain R et al performed retrospective analysis of CT scans of 30 consecutive patients with a clinical suspicion or diagnosis of spinal tuberculosis. Four patterns of bone destruction were noted, namely, fragmentary, osteolytic, subperiosteal and well-defined lytic with sclerotic margins. The fragmentary type was most common (47%). Intervertebral disc destruction was always associated with contiguous vertebral body destruction. Associated paravertebral soft-tissue masses were seen in all patients. Epidural extension of disease was seen in 66% and showed a very good correlation with neurological signs on clinical evaluation. Bone fragments were detected in the epidural soft-tissue mass in 65% of patients with epidural extension of disease. CT appearances of bone destruction are highly suggestive of tuberculous osteomyelitis in about half the patients.^[14]

In the present study, ultrasound findings in musculoskeletal tuberculosis showed presence of psoas abscess in 10 patients with tubercular spondylodiscitis while they showed synovial thickening and joint effusion in 5 patients with tubercular arthritis. Ranjeet S Narlawar et al described the MRI findings in patients with isolated tuberculous involvement of the posterior spinal elements. Involvement occurred from C2 to L5 vertebral levels. Most commonly, involvement was seen in the thoracic vertebrae (16 patients, 48.5%) followed by lumbar vertebrae (13 cases, 39.4%) and cervical vertebrae (4 patients, 12.1%). The laminae were most commonly involved (24 patients, 72.7%; 8 bilateral, 16 unilateral) followed by pedicles (20 patients, 60.6%; 6 bilateral, 14 unilateral), articular processes (19 patients, 57.5%; 5 bilateral, 14 unilateral), spinous processes (19 patients, 57.5%), and transverse processes (12 cases, 36.4%; 5 bilateral, 7 unilateral). Bone destruction and marrow changes were seen in all patients. Involvement of the entire posterior arch was seen in eight patients. A

total of 23 patients revealed extraspinal soft tissue collections. Intradiscal extradural granulation tissue/abscess was seen in 11 patients. Spinal cord was either displaced or compressed in 15 patients, and abnormal high signal intensity intrinsic cord changes were seen in eight patients. In tuberculosis of the posterior element of the spine, MRI is extremely useful in evaluating the extent of involvement and response to therapy of isolated tuberculosis of posterior elements.^[15]

CONCLUSION

The authors concluded that MRI is highly sensitive in detecting characteristic early bone marrow changes of affected bones. It is very effective in detecting soft tissue involvement along with intraspinal extension, cord compression and paraspinal extension.

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